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## ABSTRACT

An automated program for the reduction of test anxiety in a computer-based learning situation has been developed. Its main components are: 1) a self-study manual containing information and written exercises dealing with coping with test anxiety; 2) a videotape of modeled effective and ineffective coping with anxiety on tests; 3) a brief, modified systematic desensitization procedure; and 4) a session of practicing coping with anxiety in a computer-guided testing situation. The objective was to provide an inexpensive service for test-anxious students. Preliminary investigation of the program's effectiveness in the context of a sequence of computer-managed instructional modules found a highly significant reduction in self-reported test anxiety as compared with a no-contact control group of highly test-anxious students. Slight indications of improved performance on the modules for the treatment groups were also noted. Future research will be directed at overcoming difficulties in detecting improved performance following reduction of test anxiety and toward eliminating the relaxation and desensitization component of the program in favor of increased emphasis upon practicing test-taking and anxiety management skills. (Author/PB)

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DEVELOPMENT AND PRELIMINARY EVALUATION OF AN  
AUTOMATED TEST ANXIETY REDUCTION PROGRAM  
FOR A COMPUTER-BASED LEARNING SITUATION

*Technical Report No. 20*

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## ABSTRACT

Following a selective review of studies investigating the nature of test anxiety and its remediation by behavior therapy techniques, the development of an automated program for the reduction of test anxiety in a computer-based learning situation is described. The main components of the program are: a special type of self-study manual containing information and written exercises dealing with coping with test anxiety; a videotape of modeled effective and ineffective coping with anxiety on tests; a brief, modified systematic desensitization procedure; and a session of practicing coping with anxiety in a computer-guided testing situation. The program is designed to provide, ultimately, an inexpensive service for test-anxious students. A preliminary investigation of the effectiveness of the program in the context of a sequence of computer-managed instructional modules found a highly significant reduction in self-reported test anxiety as compared with a no-contact control group of highly test-anxious students. Some slight indications of improved performance on the modules in the treatment group, difficulties in detecting improved performance following reduction of test anxiety in this type of subject and learning situation, and directions for further research are also discussed.

## INTRODUCTION AND BACKGROUND

The purpose of the research summarized in this report was to develop and provide an initial test of the effectiveness of an automated program for the reduction of test-taking anxiety in a computer-based learning situation. The test anxiety program developed is automated in the sense that, unlike commonly-used test anxiety treatment methods such as behavior therapy (e.g., systematic desensitization) or study counseling, the student may complete the program on his own with no contact with a live counselor or therapist. Rather, he observes certain video tapes, reads a special type of manual on coping with test anxiety, and practices anxiety management techniques in a computer-guided practice test-taking session. The program was designed so that, when validated, it could provide a regularly available service for high test-anxious students in computer-based instruction.

There is clear and extensive evidence that anxiety can interfere with the learning process and performance on tests (Sarason, 1960; Spielberger, 1966). Suinn (1968) and Emery and Krumboltz (1967) describe the effects of test anxiety as including an inability to recall and organize material, difficulty comprehending simple sentences and instructions on exams, feelings of tension, disruption of eating and sleeping patterns prior to exams, and sometimes nausea. Test anxiety often leads to failure in the university environment (Alpert & Haber, 1960; Paul & Eriksen, 1964; Suinn, 1968). Eysenck and Rachman (1965) estimate that as many as 20 percent of students have a great deal of fear of examinations. There is evidence that highly test-anxious students receive lower grades and have a higher attrition rate than do less anxious students of equivalent intellectual ability (Paul, 1968; Spielberger, 1962; Spielberger & Katzenmeyer, 1959).

Over the past four or five years a number of college and university counseling centers have developed special treatment programs for test anxiety. Most of these programs involve the application of the behavior therapy procedure known as systematic desensitization (Wolpe & Lazarus, 1966) to

test-anxious students, either individually or in groups. The experience of psychologists and counselors in these agencies supports the notion that test anxiety is a widespread problem among students which often interferes with successful academic performance. When it becomes known that this type of program is available, students request it in large numbers. Although clinical impressions indicate that some students who are highly test-anxious are able to perform fairly well on tests in spite of intense fear and discomfort, high test anxiety may engender negative attitudes towards academic work that causes them to curtail or restrict their intellectual or professional development. However, most students who request such treatment indicate that test anxiety often substantially interferes with their performance on tests. A common pattern is the junior or senior student who has superior intellectual ability and is highly motivated to succeed, but because of severe test anxiety is barely able to stay in school and is about to have his plans to attend graduate or professional school ruined. Often students who suffer from test anxiety (which, like any phobia, does not yield to conventional "will power" methods or advice) blame themselves for the problem, thinking that they would not have it if only they tried harder or had more courage. Thus, the test-anxious student sometimes suffers from lowered self-esteem and general unhappiness as a result of his phobia.

The literature concerned with the nature and remediation of test anxiety tends to fall into two broad streams or traditions, the first dealing with test anxiety as a personality variable, the second focusing on behavior therapy treatment procedures for alleviating the problem. In very recent years these two traditions have been drawn together and allowed to cross-fertilize one another, leading to enriched perspectives on the nature of test anxiety and improved techniques for dealing with it. The automated test anxiety reduction program developed for the present study draws heavily on these new perspectives and techniques. Both of these traditions will be briefly reviewed in this report, highlighting those results which are especially relevant to the development of this treatment program.

### The Construct of Test Anxiety

The construct of test anxiety was originated by Mandler and Sarason (1952) over 20 years ago. Numerous studies by Sarason and his colleagues, from then until the present, have investigated the differences between high and low test-anxious individuals in terms of cognitive performance under a variety of conditions. In these studies, test anxiety has been assessed by the Test Anxiety Questionnaire (TAQ) (Mandler & Sarason, 1952), a 37-item questionnaire in a rating scale format; the Test Anxiety Scale (TAS) (Sarason, 1958), a 21-item measure consisting of items from the TAQ rewritten for a true-false format; or the most recent version of the TAS (Sarason, 1972a) a 37-item questionnaire consisting of the original TAQ items rewritten for a true-false format. The TAS asks individuals to report how anxious they feel in a variety of examination and test-related situations, and also to indicate whether or not they cognitively "worry" about exams or show other behaviors that presumably reflect high anxiety about tests.

The original test anxiety theory as advanced by Mandler and Sarason (1952) assumed that two kinds of learned "drives" are evoked by the testing situation. The first kind are task drives which are reduced by "responses or response sequences which lead to the completion of the task (Mandler & Sarason, 1952, p. 166)." The second kind is an anxiety drive which may elicit responses relating to task completion (thereby reducing anxiety), but may also elicit responses which interfere with task completion. These responses may be "manifested as feelings of inadequacy, helplessness, heightened somatic reaction, anticipations of punishment or loss of status and esteem, and implicit attempts at leaving the test situation (p. 166)." In a later article, Sarason (1960) summarized this view of test anxiety, which interprets anxiety as habitual, interfering responses, in the following manner:

This interpretation, briefly put, states that Ss scoring high and low in anxiety differ in the response tendencies activated by personally threatening conditions. Whereas low scoring Ss may react to such conditions with increased effort and attention to the task at hand, high scoring Ss respond to threat with self-oriented, personalized responses (p. 405).

Recent summaries of the research findings relevant to this interpretation of test anxiety have been provided by Sarason (1972a) and Wine (1971a). They present a clear pattern of results supporting predictions derived from test anxiety theory concerning the differential performance of high and low test-anxious SS under conditions or instructions which are stressful or arouse achievement anxiety. Almost all of these studies have explored performance differences on various types of verbal learning laboratory tasks, such as the serial learning of low-meaningfulness disyllables. Wine (1971a) summarizes the results of a number of these studies dealing with instructional manipulations (e.g., Sarason, 1961; Sarason & Harmatz, 1965; Sarason & Palola, 1960; Sarason & Minard, 1962) in the following manner:

The results of studies varying instructional conditions have generally reported an interaction between level of test anxiety and evaluation emphasis: (a) Highly test-anxious subjects perform more poorly following highly evaluative "ego-involving" instructions than nonevaluative "anonymous" instructions . . . (b) Following highly evaluative instructions, low test-anxious subjects perform better than high test-anxious subjects; following nonevaluative instructions, high test-anxious subjects perform better than low. (c) Following minimal task instructions, high and low test-anxious subjects perform at about equivalent levels, intermediate between their performances in the highly evaluative and nonevaluative conditions (p. 96).

The results of these experimental studies are buttressed by additional, correlational investigations that have consistently found that high as compared with low test-anxious individuals tend to perform relatively poorly on a number of different types of ability tests (Phillips, 1972; Sarason, 1960).

Other studies in this tradition have illumined in more detail the manner in which highly anxious individuals approach evaluative tasks and the nature of the interfering responses that appear to lower their performance. In general, test-anxious persons are very responsive to social cues of all sorts, including modeling cues, persuasion, and conformity pressures (Wine,

1971a; Sarason, Pederson, & Nyman, 1968). Partly for this reason, it appears, they have difficulty discriminating between relevant and irrelevant information to the solution of problems (West, Lee, & Anderson, 1969). It has been shown that the highly anxious person attends to fewer task cues than his low anxious counterpart (Wachtel, 1968), and that under stressful conditions in particular his range of appropriate cue utilization is sharply reduced (Easterbrook, 1959). Finally, a number of studies by Sarason (Sarason & Ganzer, 1962, 1963; Sarason & Koenig, 1965) have demonstrated the pronounced self-deprecatory, self-ruminative tendencies of test-anxious persons who not only engage in debilitating self-oriented thinking in highly evaluative situations, but generally describe themselves in more negative terms in any performance situation than low test-anxious persons. These last results suggest that the interfering responses that reduce performance may consist in large part of cognitive activities, namely personalized, self-oriented, self-deprecatory thinking on the part of the high test-anxious individual.

Several recent studies lend further support to this view. Based on Sassenrath's (1964) factor analysis of the TAQ, Liebert and Morris (1967) distinguished between "worry" (fearful, self-critical thinking) and "emotionality" (autonomic arousal) components of test anxiety, and developed a 10-item Worry-Emotionality Scale to measure these separate components. Further research has indicated, generally, that worry consistently shows a significant negative correlation with task performance and performance expectancy, whereas emotionality does not correlate with performance expectancy, and is inversely related to performance only for subjects whose worry scores fall below the group median. Among high worry subjects, the presence or absence of high emotionality makes no difference in terms of performance (Spiegler, Morris, & Liebert, 1968; Doctor & Altman, 1969; Morris & Liebert, 1969, 1970).

Only two studies in this long series of investigations regarding the nature of test anxiety and its influence on cognitive performance have attempted to modify test anxiety and its interfering responses. Sarason et al. (1968) showed that the opportunity to observe a model performing at a



serial learning task improved the subsequent performance of test-anxious subjects at this same task. This beneficial effect on performance was much greater for high than for low test-anxious subjects. This study was undertaken partly to demonstrate the responsiveness of test-anxious SS to social and modeling cues, but apparently this very responsiveness led anxious SS to benefit from the observation of a model responding in a business-like and task-relevant manner to the learning task. Sieber (1969) provided high and low test-anxious children with "memory supports" or visual displays of earlier stages of a multi-stage task and found that the visual display, as compared with a no-display condition, enhanced the performance of highly test-anxious children. Wine (1971a) points out that these "memory supports" might be better described as a technique for sustaining attention to task-relevant variables.

In a recent review of test anxiety research on its "20th anniversary" Sarason (1972a) stresses the need to turn attention to the development of therapeutic approaches to test anxiety, hopefully combining "the best features of extant behavior influence methods (p. 399)" in programs designed to alleviate this difficulty. In this review, also, Sarason partially revises test anxiety theory. He chooses no longer to discuss test anxiety in terms of "motivational levels and level of situationally-induced drive (p. 387)," and recast test anxiety theory in more simple and direct terms relating to attention and the uses of information or cues. He says that

what distinguishes the high test-anxious individual are (1) the manner in which he attends to the events of his environment and (2) how he interprets and utilizes the information provided by these events. These characteristics may be viewed as habits or acquired attributes whose strength is influenced by specific types of person-environment encounters (p. 382).

Curiously, Sarason's review of test anxiety research and call for work on therapeutic and preventative treatment methods almost completely ignores the large volume of research dealing with the applications of behavior therapy

treatment techniques to the reduction of test anxiety. Part of the reason for this omission may be due to the fact that until very recently behavior therapists and researchers have treated test anxiety as a simple phobia or conditioned emotional response, something quite different from the construct of test anxiety as "worry" or interfering cognitive responses.

### Behavior Therapy for Test Anxiety

Reviews by Chestnut (1965) and Allen (1972) present strong evidence that conventional group counseling procedures or study skills training by themselves do not facilitate improved academic performance in test-anxious students. In contrast, beginning with a case report by Paul and Eriksen (1964) numerous studies have shown that the behavior therapy procedure called systematic desensitization, devised and introduced to the field in book form by Joseph Wolpe about 15 years ago (Wolpe, 1958), can be effective in the treatment of test anxiety and improvement of academic performance. Paul (1969) and Allen (1972) review most of the over 20 controlled studies that have appeared since 1964 showing desensitization to be effective in reducing test anxiety (a few well-designed studies with negative results, however, should be noted [e.g., Lomont & Sherman, 1971]): Many college and university counseling centers now offer desensitization programs for test anxiety to students.

A vast amount of research has demonstrated conclusively that systematic desensitization therapy (Wolpe, 1958, 1969) can reliably produce measurable benefits for clients with a wide range of emotional and behavioral problems in which anxiety plays a fundamental role (Paul, 1969). In desensitization therapy the client is trained in a deep muscle relaxation procedure (Jacobsen, 1938) and then instructed to visualize, while relaxed, an ordered series of scenes called an anxiety hierarchy. As he proceeds gradually up the hierarchy the client, in the scenes, comes into progressively closer or more intense contact with the feared situation or stimulus. Following successful treatment the client is able to approach the previously feared situation with greatly reduced or no anxiety.

Wolpe (1958, 1969) and what might be called the "classical" behavior therapy tradition view situation-specific anxiety reactions or "phobias" like test anxiety as reflexive conditioned emotional responses, usually brought about by some "traumatic" conditioning process in which a previously neutral event or stimulus (like tests) is paired with some unconditioned aversive stimulus (like punishment or humiliation) until the formerly neutral stimulus comes to elicit strong anxiety and leads to avoidance behavior. Generally, systematic desensitization has been viewed as a procedure that "counterconditions" this conditioned anxiety response. In Wolpe's (1958) original formulation of systematic desensitization, counterconditioning effects are explained in terms of "reciprocal inhibition," that is in terms of reciprocally inhibiting processes occurring at the level of the autonomic nervous system. It is assumed that muscular relaxation and other responses used to counter anxiety elicit parasympathetic responsiveness which is physiologically antagonistic to and tends to inhibit the sympathetic responsiveness of anxiety. In desensitization therapy a response antagonistic to anxiety (relaxation) is made to occur in the presence of an imaginal representation of the anxiety-evoking stimuli; gradual presentation of these stimuli permits a suppression of the anxiety response and eventual deconditioning of the anxiety response.

While continued research has established the effectiveness of desensitization as a specific, operationalized, replicable treatment procedure for many anxiety problems, including test anxiety, it has not supported Wolpe's account of the mechanisms of fear reduction. Bandura (1969) and Lang (1969) summarize studies showing that anxiety cannot be identified with peripheral physiological states. It now appears doubtful that the effects of desensitization can be explained by a single principle such as counterconditioning. Expectancy of therapeutic gain and the therapist as a reinforcer of non-fear behavior have been shown to play a role in desensitization. More importantly, very recent research and theoretical speculation has focused on cognitive variables in desensitization. Wilkins (1971) argues that information feedback and "instructed imagination" appear to play a central role in

desensitization. He points out that desensitization subjects are given a kind of direct training in shifting their attention in a controlled manner towards and away from the threatening situation, a skill which may play a central role in coping with anxiety in real-life situations. Consistent with this, Bandura (1969) argues that phobic reactions like test anxiety in humans are not reflexive conditioned emotional responses. He cites a wide array of evidence to show that fear is not an automatic emotional response to an external stimulus, but a state of emotional arousal that is "cognitively self-generated" by means of panicky thoughts and images by the person in the threatening situation. Thus, behavior therapists are beginning to discuss anxiety and its treatment in terms that are commensurate with the analysis of test anxiety by Sarason and his colleagues. In fact, there is a close parallel between what Sarason calls "personalized, self-oriented thinking" and cognitively self-generated fearful thoughts and images as discussed by Bandura.

Many of the studies investigating the controlling variables in desensitization have shown as a by-product that the treatment procedure is a robust process which is not adversely affected by minor alterations in procedural details (Lang, 1969). Recently, some researchers have turned their attention directly to developing briefer, more economical forms of desensitization treatment. For example, the time required for treatment has been shortened or the ease of its administration increased through such developments as group treatment (Paul & Shannon, 1966; Suinn & Hall, 1970), the use of standardized rather than individualized hierarchies for common problems such as test and mathematics anxiety (Emery & Krumboltz, 1967; Richardson & Suinn, 1972, in press), and accelerated treatment using only the top portion of the customary anxiety hierarchy (Suinn, Edie, & Spinelli, 1970; Richardson & Suinn, 1972). Several recent studies (Hall, 1970; Mann & Rosenthal, 1969; Mann, 1972; Richardson & Hall, 1972) have investigated a vicarious desensitization procedure in which clients merely observe the live or video-taped desensitization treatment of other clients, finding that this procedure may also be effective in the treatment of test anxiety.

In a sense, all these innovations create the possibility of more or less automated treatment procedures. A number of recent studies have explored the use of audio or videotape recordings to conduct desensitization or desensitization-like treatments (Donner & Guerney, 1969; Suinn & Hall, 1970; Suinn & Richardson 1971), with no apparent loss in effectiveness. Several major university counseling centers (e.g., the Counseling-Psychological Services Center at The University of Texas at Austin) offer partially automated desensitization for test anxiety programs to students, usually group desensitization programs in which the initial relaxation training and anxiety hierarchy scenes are presented by videotape recordings.

#### New Approaches to Test Anxiety Treatment

Wine (1971a) concludes that her extensive review of the literature on the construct of test anxiety and some related studies supports "an attentional interpretation of the debilitating effects of test anxiety on task performance (p. 99)." The primary difficulty with the test-anxious individual, she contends, is that he habitually withdraws his attention from variables and activities relevant to performing on the task or test and focuses his attention instead on himself, on worried thoughts about his competence, his ability or performance as compared with other students, or the consequences of doing poorly at the task. She stresses that this attentional view of test anxiety is concerned with how the individual uses or directs his cognitive activity, how he divides his attention between task and self, and has little concern with emotional or autonomic arousal per se.

Wine notes that at the time of her review, all the published accounts of treatment for test anxiety have involved variations on systematic desensitization techniques. She comments that while desensitization has been generally found to produce reliable, beneficial effects on self-report of anxiety and scholastic performance,

it is noted that these studies have evolved from interest in specific treatment techniques, rather than from an analysis of the nature and effects of test anxiety...it has been

implicitly assumed that test anxiety differs only in degree from the specific anxieties and phobias (e.g., rat, spider, snake) dealt with in much of the behavior modification literature...also...training test-anxious subjects to relax in the presence of progressively more stressful stimuli... assumes that the emotional arousal component of test anxiety is its defining characteristic (p. 101).

In addition to providing this cognitive and attention interpretation of the literature on test anxiety, Wine (1971a, 1971b) has devised an attentional training procedure that aims directly at modifying these variables. In this approach Ss are given a rationale for the treatment that stresses that test-anxious individuals waste much of their time in self-evaluative worry. Then they are exposed to two brief videotapes which show two college student models (five minutes each) focusing their attention on themselves in an evaluative manner in a laboratory learning and an oral examination situation, making irrelevant comments and not paying attention to many task-relevant variables. They also view two other models (five minutes each) who focus their attention on the task and work in a business-like manner in similar testing situations. Finally, and most importantly, Ss are given intensive practice on a variety of test-like tasks with instructions and training to inhibit self-relevant thinking and focus attention on the task at hand. Results show that this program was highly effective in reducing self-report of anxiety and improving performance on several test-like behavioral measures.

Meichenbaum (in press) has devised a "cognitive modification" program for the reduction of test anxiety which is somewhat similar to Wine's attentional training, but undertakes to modify more systematically some of the cognitive variables that are thought to mediate effective test-taking behaviors. In the first phase of this cognitive modification program Ss undergo an "insight" therapy procedure in which they are made aware of the specific self-oriented, task-irrelevant, worried thoughts they characteristically emit in the testing situation. Then they generate a set of alternative, incompatible "self-instructions" or instances of "self-talk" which

have the opposite effects of avoiding worry and directing the Ss' attention to the task at hand. In the second phase of treatment, Ss go through a brief, modified desensitization procedure in which they visualize themselves actively coping with test anxiety in a graded series of test-taking scenes. Instead of the conventional desensitization procedure of visualizing oneself perfectly calm and relaxed in the fear situation, this part of the cognitive modification treatment employs what Meichenbaum calls "coping imagery" in which the S visualizes himself beginning to get a little anxious but then coping successfully with anxiety by means of slow deep breaths and appropriate self-instructions and self-talk. Results showed that this cognitive modification treatment program was significantly more successful in reducing test anxiety, as assessed by several self-report and performance measures, than a conventional systematic desensitization treatment procedure of the same length.

In Wine's attentional training and Meichenbaum's cognitive modification program the two main streams of test anxiety research outlined above merge, resulting in powerful new approaches for the alleviation of test anxiety. Meichenbaum (in press) explicitly adopts the Sarason-Wine interpretation of test anxiety as self-oriented thinking and inattention to the task, and argues that his cognitive modification program is simply the application of conventional behavior modification principles (modeling, reinforcement, etc.) to the phenomenon of private speech, which appears to be crucial to test anxiety. It should be noted that despite the comment of Wine's quoted above to the effect that systematic desensitization focuses on the modification of emotional rather than cognitive factors in test anxiety, current reinterpretations of desensitization within behavior therapy circles (Lang, 1969; Wilkins, 1971; Bandura, 1969) stress the importance of cognitive variables in the desensitization process. It may be that systematic desensitization has provided clients with bits and pieces of what amounts to relaxation, attentional training, cognitive restructuring, and other effects. The task at hand for applied researchers appears to be to separate out these several treatment or training processes and provide them to clients in more concentrated and systematic doses, depending on the behavioral deficit or problem they present.



### Development of an Automated Test Anxiety Reduction Program

Several studies have investigated the measurement and reduction of debilitating anxiety in a computer-assisted instruction context (Leherissey, 1971; Leherissey, O'Neil, & Hansen, 1971, O'Neil, Hansen, & Spielberger, 1969; O'Neil, Spielberger, & Hansen, 1969). The results of these studies have, in general, convinced the present investigators that high anxiety often interferes with performance on tests in a computer-based learning situation, but have discouraged the belief that available modifications in instructional design or the manner of presentation of test material will substantially reduce test anxiety, especially in that sizeable minority of highly test-anxious individuals who appear in any student population.

Wishing to devise an automated test anxiety reduction program that could provide an inexpensive and efficient service for test-anxious students in a computer-managed instruction context, the authors reviewed all the above literature on test anxiety and its treatment for techniques or approaches that might be incorporated into or modified for such an automated program format. The program developed also includes several relatively novel approaches to assisting a student in coping with test anxiety. The principal components of this program are described below. Details concerning the procedure students follow in completing the program are presented in the Method section of this report.

In this program each student reads and completes some written exercises in a special type of manual on coping with test anxiety written for the program. The entire text of this 90-page manual is available in a separate technical report (Richardson, 1973). A number of prominent writers in the fields of psychotherapy and behavior modification have stressed recently that the straightforward provision of new information about behavior and the environment may be an overlooked but perhaps basic ingredient in most behavior change procedures (Lazarus, 1971; Murray & Jacobson, 1971; Urban & Ford, 1971; Sarason, 1972a), one that could profitably be expanded and utilized in a more



systematic manner (Sarason, 1972a). Clients who receive one or another form of test anxiety treatment are usually treated in a manner based on some reasonably well-developed theory about test anxiety and its alleviation, but they are usually not provided with the full extent of available information about the behavioral and emotional dynamics of test anxiety and techniques for coping with it. Yet, in many cases, simply the provision of new and useful information about these matters may enable a student to modify his test-anxious behavior. Also, conveying this information in a permanent written form may be not only a more economical, but also a more effective way of making it available as a resource to the student. The manual developed for this program is a novel attempt to present comprehensive information about test anxiety and coping with it to anxious students in a manner most likely to assist them in implementing new behavioral strategies in the testing situation.

The manual is divided into three parts. The first part describes and diagrams the process whereby new information (e.g., that directing attention to the task instead of to oneself during tests lowers anxiety) may lead to new coping solutions for behavioral problems, and stresses that intelligent adults are often able to utilize new, accurate information in this manner without the intervention of a professional helper. A brief section then presents some guidelines for the reader in the use of the manual, encouraging them to use imagination and fantasy in certain ways in absorbing the material, to be sure to relate the material to their personal experiences, and to complete the written portions of the manual which will aid them in working the new information into their behavioral functioning. This section simply restates accurately in non-technical terms the author's rationale and expectations for the manual as a treatment device. Several sample "case histories" of test anxiety in college students are recounted, giving an idea of the range of background events and symptoms commonly found in test-anxious students. Then the reader completes a test anxiety checklist containing a comprehensive list of symptoms of test anxiety in order to acquaint himself in detail with the manner in which high anxiety manifests itself in his behavior and thinking

on tests. This part of the manual concludes with a relatively lengthy discussion of some different sources of test anxiety. It is claimed that high and debilitating anxiety on tests may usually be ascribed to (1) lack of ability or preparation, (2) lack of motivation or interest, (3) a reflection of other emotional or behavioral concerns, or (4) test anxiety. Test anxiety is defined as both a kind of automatic, habitual reaction of anxiety to tests which is difficult to control, and something the student actively does to himself in terms of self-oriented panicky thinking and fantasizing that generates high anxiety. Some detailed examples of lack of preparation, lack of motivation, and the intrusion of other concerns are given, for example, the instance of the student who is pursuing a major that was chosen for him by his parents, is resentful, has difficulty studying, and then gets anxious on tests. The solution in this case is to become aware of one's own wishes and resolve the conflict with one's parents, not treatment for test anxiety. The purpose of this section is to provide a self-screening procedure so that individuals for whom the program is not appropriate may deselect themselves from it. The assumption is made that in most cases students are capable of deciding for themselves whether or not the program is appropriate for them. They are asked to make some written notes on the extent to which these various factors play a role in their test anxiety, and to decide whether any of the factors besides test anxiety play the predominant part in their difficulties with tests. If this is the case, they are told, they may wish to consult with a faculty member or professional counselor about the matter.

The second part of the manual provides detailed information about the behavioral and emotional dynamics of test anxiety, and about a number of strategies for coping with it. First, there is a discussion of anxiety on tests that makes the point that while there is good reason to be somewhat anxious about tests, especially in this society which places a great deal of pressure on its members to compete and succeed at school and work, there is no good reason for the capable and prepared student to panic or "freeze up" on tests. It is asserted that the only difficulty for such students is to cope adequately with the anxiety that is ubiquitous and quite normal on

tests. Techniques for coping with test anxiety are discussed under four headings: (1) emotional state, (2) the direction of attention away from self and to the test, (3) eliminating anxiety arousing self-talk, and (4) the overall management of preparation, time and pressure before and during tests. A relaxation technique of slow deep breathing and procedure for practicing it are outlined for dealing with physical tension and related emotional arousal. The difference between self-oriented and task-oriented thinking on tests is discussed in detail and parallels in other behavioral spheres (such as social anxiety) are described. A number of illustrations of the process of task-oriented thinking on tests are given, such as using task-relevant fantasy and free association to assist recall, and stopping the process of reflection when a "best answer" is first determined on a multiple choice type test, avoiding further fruitless rumination. Exactly where and how self-oriented thinking usually enters the process is illustrated for the reader. In the section on self-talk, a number of examples of panicky self-instructions and self-talk (collected for this research by the authors from students written records of their ruminations during tests, taken immediately after completing examinations) are provided for the reader, as well as a representative list of examples of appropriate self-talk that tends to focus attention on the test rather than oneself. In the section on overall management of time and preparation several general considerations regarding behaving in a manner that fosters a sense of control over the preparation and completion of tests are discussed. It is stressed that often behaving as if one felt calm and confident about tests often brings anxious feelings into line.

The third and final part of the manual contains a series of written exercises in which the student outlines for himself behavioral strategies for coping with test anxiety. For example, he generates a list of instances of panicky self-talk in his own case, and then develops a list of alternative, incompatible self-statements that might be used to counter anxiety and foster task-relevant thinking and behavior. And he is asked to follow certain guidelines (including review of previous written material) in devising several

realistic strategies for fostering a sense of control and maintaining attention to the test in his own individual case.

Another component of the program exposes Ss to a videotape presentation of a female student modeling effective and ineffective management of anxiety on tests. The videotape presentation is composed of the following segments: (1) a therapist briefly describes (five minutes) how panicky self-talk and inattention to the test or task interfere with smooth performance on tests for highly anxious students; (2) the tape (five minutes) displays instructions for operating a computer terminal and some of the intelligence test questions to be read and responded to by the model in the following segments, as they appear on the cathode-ray tube of a terminal in a computer-learning situation--this familiarizes the viewer with the exact nature of the task dealt with by the model, thereby increasing its meaning and informational value (Sarason et al., 1968); (3) the model (10 minutes) approaches the terminal to take a computer-based intelligence test, reads the instructions, and answers some test questions, exhibiting panicky self-talk (spoken out loud by the model), difficulty in attending to the task, worry about self and performance, and rising anxiety, eventually "freezing up" on the test; (4) the model (10 minutes) repeats the same sequence of approach, reading instructions, and answering questions, but this time exhibits appropriate self-instructions and self-talk that facilitate focusing her attention on the task and dealing with difficult questions, copes with anxiety and tension on two occasions taking several slow deep breaths, and generally conducts herself in a task-oriented and business-like manner, leading to positive results and satisfaction.

A third component of the program consists of a modified desensitization procedure along the lines of Meichenbaum's (in press) cognitive modification treatment for test anxiety. Subjects are given a half-hour of deep muscle relaxation instructions administered by a therapist on videotape and encouraged to practice the exercises at home. At a later date they are instructed by videotape to visualize themselves coping with mild anxiety in a graded series of test-taking scenes by slow deep breaths and the use of appropriate self-instructions to relax and pay attention to the test.

In the final component of the program Ss practice responding to test-like questions at a computer terminal. Instructions presented by the CRT remind them of the slow deep breathing technique for combating physical tension and anxiety, and of the importance of paying attention to the test and avoiding self-oriented worry. They are encouraged to practice these anxiety management techniques while answering the questions. They are told that the questions come from a computerized intelligence test, but that their answers will not be scored. In fact they are given about half of the items, ordered from easy to hard, from the Computer-Based Slosson Intelligence Test (Hedl, 1971), which has been found to elicit high levels of state anxiety in subjects (Hedl, O'Neil, & Hansen, in press), in a practice test-taking session lasting about 45 minutes for most Ss.

The following section of this report describes the method used to provide an initial test of the effectiveness of this program in reducing general test anxiety and state anxiety, and improving academic performance in highly test-anxious students.

## METHOD

### Subjects

All 16 subjects (Ss) were undergraduate education majors at The University of Texas at Austin taking a required course in Educational Psychology during the fall semester of 1972. Part of this course consisted of a sequence of five instructional modules managed by computer. All Ss completed the Test Anxiety Scale (TAS) (Sarason, 1972a) at the beginning of the module sequence and were selected from 200 students because their scores fell in the upper 15 percent of scores recorded for another group of 330 students enrolled in sections of the course who had completed the module sequence a month earlier. Twelve students from a list of high TAS scorers were contacted by phone and asked if they would like to participate in the treatment program. Three of these students indicated high interest in the program, but declined to participate at that time because of current pressures relating to upcoming tests! Nine students agreed to participate, one of whom withdrew after the first treatment session because of academic pressures. This left eight students--four male and four female--who formed the treatment group for this study. These students did not receive any course credit for taking part in this research but were paid six dollars each for their participation in the study which took six to nine hours of their time during a single week. A no-contact control group was formed by selecting eight other high TAS scorers, who, at the request of the experimenter, completed the TAS "for research purposes" following the treatment period and completion of most of the instructional modules as detailed in the section below on procedure.

### Apparatus

An IBM 1500 computer-assisted instructional system was used for the presentation of all module tests and the five-item state anxiety measure. Each terminal consists of a cathode ray tube for the presentation of materials, and a typewriter keyboard for Ss' responses. Eight terminals are located in a large, air-conditioned room, and separated by sound-insulated walls. The computer data management system automatically records all pertinent data.

The sessions of the test anxiety reduction program took place in a 6' x 12' sound-deadened room containing only one computer terminal. In addition, this room contained a comfortable chaise longue and a television monitor and playback unit for the presentation of the videotape components of the program.

### Learning Materials

During the fall semester, 1972, 200 students in five sections of an introductory educational psychology course (including the treatment and control ss for this study) completed a five-module computer-managed instructional sequence developed by the Computer-Assisted Instruction Laboratory at The University of Texas at Austin. In this sequence of modules, each student studies conventional printed learning materials, guided by behavioral objectives, until he completes the readings assigned for a module. He then takes a test, keyed to the objectives, at a computer terminal. He receives feedback at the end of the test consisting of his total score on the module and his percentage score on each objective. If he fails to reach an overall criterion of 75% correct, he is required to take a retest at a later date. At the time of the retest he is tested only over the previously-failed objectives. Immediately following each test, before receiving his performance score, the student responds to a computer-administered five-item state anxiety scale.

The five instructional modules covered the following topics in the following sequence: (1) Computers in Education; (2) Statistics in the Classroom; (3) Tests and Measurement; (4) Classroom Management; and (5) Cultural Differences. Each of the modules except the second, the Statistics module, is followed by a single computer-administered test. The Statistics module is broken down into five units, each followed by an individual subtest. Within certain overall time limits, students complete the modules and module tests on a self-paced basis. They completed the first four modules during the second month of the semester at the rate of approximately one module per week. Three weeks later in the semester, they completed the final module and module test. A formative evaluation of this computer-managed course demonstrated that the

percentage of Ss reaching criterion exceeded 90 percent on the first four modules and approximated 80 percent on the fifth module (Judd, O'Neil, Rogers, & Richardson, 1972). Subjects' expressed attitudes toward the course were, in general, quite positive.

### Instruments

The instruments for this study included two measures of general test anxiety and a measure of momentary anxiety. Also, performance scores on module tests and the number of retests for Ss were examined to determine if the treatment group, as compared with the control group, showed improved performance as a result of the test anxiety reduction program.

The Test Anxiety Scale (Sarason, 1972a) is a 37-item self-report instrument in true-false format developed to measure anxiety elicited in a number of academic testing situations. It is a lengthened version of an earlier 21-item Test Anxiety Scale (Sarason, 1958) which was based largely on the items of the original Test Anxiety Questionnaire (Mandler & Sarason, 1952). As reported by Sarason (1972b), test-retest reliability figures for the 37-item scale range between .75 and .80. Different versions of the Test Anxiety Scale have been found to correlate with grade point average ( $r = .24$ ,  $p < .05$ ) (Alpert & Haber, 1960). Significant changes in Test Anxiety Scale scores have accompanied grade point average increases following systematic desensitization of test anxiety (Cohen, 1969; Katahn, Strenger, & Cherry, 1966).

The Suinn Test Anxiety Behavior Scale (STABS) is a 50-item scale designed to identify test anxiety and measure changes in it following treatment. Each item is a brief description of some event or situation relating to test-taking that may evoke anxiety. Subjects are asked to respond to each item in terms of how much anxiety that event or situation causes them to feel, on a scale from 1 (not at all) to 5 (very much). Suinn (1969) reports a test-retest reliability coefficient of .78 over a four-week period and validity data showing that STABS scores correlate with final course grades and positively with Sarason's TAS. The STABS has been used as a pre-post measure of test anxiety in a number of desensitization studies (Suinn & Hall, 1970; Richardson & Suinn, in press; Richardson & Hall, 1972).



The State Anxiety Scale (O'Neil, 1972) is a shortened, five-item form of the State Anxiety Scale of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). It is designed to measure momentary feelings of anxiety or state anxiety (A-State), as opposed to trait anxiety or a general behavioral disposition to perceive a wide range of objectively non-dangerous circumstances as threatening (Spielberger, 1966). The brevity of the A-State scale permits insertion of state anxiety measures into actual testing situations, allowing a direct self-report measure of momentary level of anxiety instead of indirect assessment of state anxiety through measures of performance and other indices. O'Neil (1972) reports that alpha reliabilities of the scale for subjects involved in computer-assisted learning tasks and a computer-based intelligence test range from .83 to .93 in 17 comparisons. This points to a high internal consistency for the scale in these areas of research.

### Procedure

Testing Procedure. The TAS was completed by all Ss at the beginning of the module sequence, along with the rest of the 200 students enrolled in five sections of the introductory educational psychology course. At the end of four weeks of computer-managed instruction (treatment occurred during the second week of this period), following completion of the fourth module test, all Ss completed the TAS for the second time.

The STABS was completed by only the treatment Ss immediately before the first of three scheduled treatment sessions and immediately following the last of these sessions, at intervals varying from three to five days.

The A-State measure was completed by Ss immediately after (before performance feedback) each module test and retest. The items, like the module test questions, were administered by the computer and presented to Ss on the terminal's cathode ray tube display.

Treatment Procedure. During the first week of the computer-managed instruction period, the senior author of this report called the 12 high TAS scoring Ss and invited them to participate in the test anxiety reduction program. He presented himself as a psychologist doing research on a test anxiety program that was in some respects experimental, but contained a variety of procedures that have been found effective in reducing test anxiety. A bare minimum of discussion of the Ss' difficulty with test-taking was carried on in order to see if the self-screening section of the manual would later deselect any inappropriate Ss. Ss were told that they would be interviewed by this psychologist after the treatment program was completed to glean their suggestions for its improvement. The nine Ss who volunteered were immediately scheduled for three separate, individual treatment sessions in the treatment room described above. For each S, the sessions were scheduled for the following week on separate days of that week at hours arranged, so far as possible, to the Ss' convenience. Finally, each S was asked to stop by the Computer-Assisted Instruction Laboratory and pick up a copy of the manual before the weekend.

The treatment procedure for each S (outlined on an explanatory sheet accompanying the manual) consisted of five parts: (1) reading the first two parts of the manual over the weekend; (2) attending the first scheduled session, consisting of watching an hour-long videotape, the first half-hour being the modeling sequence, and the second half-hour being deep muscle and slow deep breathing relaxation instructions; (3) reading the third part of the manual and completing the written exercises it contained; (4) attending the second scheduled session, consisting of viewing a second hour-long videotape presenting the modified desensitization component of the program; and (5) attending the last scheduled session of the program, the practice test-taking session at the computer terminal. A secretary on duty during that week at a desk just outside the treatment room checked Ss in and out, rewound the videotapes after each session using a tape, and showed Ss how to sign on at the terminal for the practice test-taking session. The program took about six to nine hours of each S's time, depending

on the time and care with which they read the manual and worked on its written portion. Only three hours of this time, however, utilized Computer-Assisted Instruction Laboratory facility and staff time.

During the week after treatment the psychologist who initially contacted Ss about the program conducted a 20-minute interview with each S concerning his or her reaction to the program and suggestions for improving it. The experimenter made every effort not to offer any advice, counseling, or further treatment of any sort during these interviews, but obviously the effects of the treatment program proper are confounded with any beneficial effects of this interview so far as posttest TAS scores and performance measures are concerned.

All treatment Ss completed the test anxiety program during the second week of the computer-managed instruction period. These Ss had completed the first module test before the treatment week began and were working on the second, Statistics, module during that week. Treatment Ss completed the test anxiety program before taking the tests over the third, fourth and fifth modules. In the following analyses, therefore, the performance and A-State scores on the first module are considered pretest scores, while performance and A-State scores on the last three modules are examined for possible treatment effects. A-State and performance data from the second module were excluded from the analyses.

## RESULTS

### General Test Anxiety

A one-way analysis of variance with repeated measures was performed on the treatment group's STABS scores obtained immediately before and after treatment. The group's mean STABS score before treatment was 155.88 (S.D. = 34.61), while after treatment it was 126.00 (S.D. = 43.44). The analysis indicated a trials effect marginally significant at the  $p = .06$  level ( $F = 5.35$ ,  $df = 1/7$ ).

In order to investigate pretest to posttest changes in general test anxiety as measured by the TAS for the treatment as compared with the control group, a  $2 \times 2$  factorial analysis of variance with repeated measures on the last factor was performed on the groups' TAS scores. The levels of the first factor were the presence and absence of treatment for test anxiety, and the levels of the second factor were pretest and posttest administration of the measure. The means and standard deviations of TAS scores before and after the first four instructional modules for the two groups are presented in Table 1. As may be observed in Table 1, the mean TAS scores for the control group remained relatively constant, while the mean scores for the treatment group sharply decreased from pretest to posttest. The analysis of variance indicated that this interaction was significant ( $F = 11.15$ ,  $df = 1/14$ ,  $p < .005$ ).

In order to insure that the two groups did not differ in initial level of general test anxiety as measured by the TAS, a one-way analysis of variance was performed on the pretest TAS scores. The results indicated that the two groups did not differ significantly in initial level of test anxiety.

### State Anxiety During Computer-Managed Instruction

In order to investigate the impact of the test anxiety reduction program on state anxiety measured immediately after each module test, a

Table 1  
PRE-POST MEANS AND STANDARD DEVIATIONS ON THE  
TEST ANXIETY SCALE FOR TREATMENT AND  
CONTROL SUBJECTS

	$\bar{X}$	<u>Pre</u>	SD	$\bar{X}$	<u>Post</u>	SD
Treatment	27.50		3.42	16.0		6.71
Control	25.88		1.46	24.25		4.03

2 x 4 factorial analysis of variance with repeated measures on the last factor was performed on the two groups' pretest (following the first module test) and posttest (following the third, fourth and fifth module tests) A-State scores. The means and standard deviations of the A-State scores for the two groups before and after treatment are presented in Table 2.

The analysis indicated a groups x trials interaction ( $F = 7.72$ ,  $df = 3/42$ ,  $p < .005$ ). As may be seen in Figure 1, no other main effects or interactions were significant.

A one-way analysis of variance was performed on the pretest A-State scores for the two groups in order to determine whether the two groups differed in terms of initial level of state anxiety. The results indicated that although the mean level of state anxiety for the treatment group was higher than that of the control group, the difference between them only approached statistical significance ( $F = 3.25$ ,  $df = 1/4$ ,  $p < .09$ ).

#### Performance Data: Module Test Scores

In order to investigate the impact of the test anxiety reduction program on module test scores, a 2 x 4 factorial analysis of variance with repeated measures on the last factor was performed on test scores for the two groups. The independent variables were treatment condition (present vs. absent) and time at which the module tests were taken (pretest following the first and posttest following the third, fourth and fifth modules). The means and standard deviations of the mean proportions correct on the test for the two groups on these four occasions are presented in Table 3. The results indicated a main effect for trials ( $F = 6.03$ ,  $df = 3/48$ ,  $p < .002$ ). The mean proportion correct scores collapsed across the two groups for the four module tests were .79, .82, .81, and .69. No other main effects or interactions were significant.

A one-way analysis of variance performed on the two groups' test scores on module 1 indicated no significant difference between the treatment and control groups at pretesting.

Table 2  
A-STATE MEANS AND STANDARD DEVIATIONS ON MODULE  
TESTS BEFORE AND AFTER TREATMENT FOR TREATMENT  
AND CONTROL SUBJECTS

	Pre-Treatment Module Test 1		3	SD	Post-Treatment Module Test 4		5	SD
	$\bar{X}$	SD			$\bar{X}$	SD		
Treatment	14.12	3.44	9.62	3.37	9.87	3.60	11.00	4.78
Control	10.75	4.02	13.87	4.79	13.75	4.78	12.25	5.82

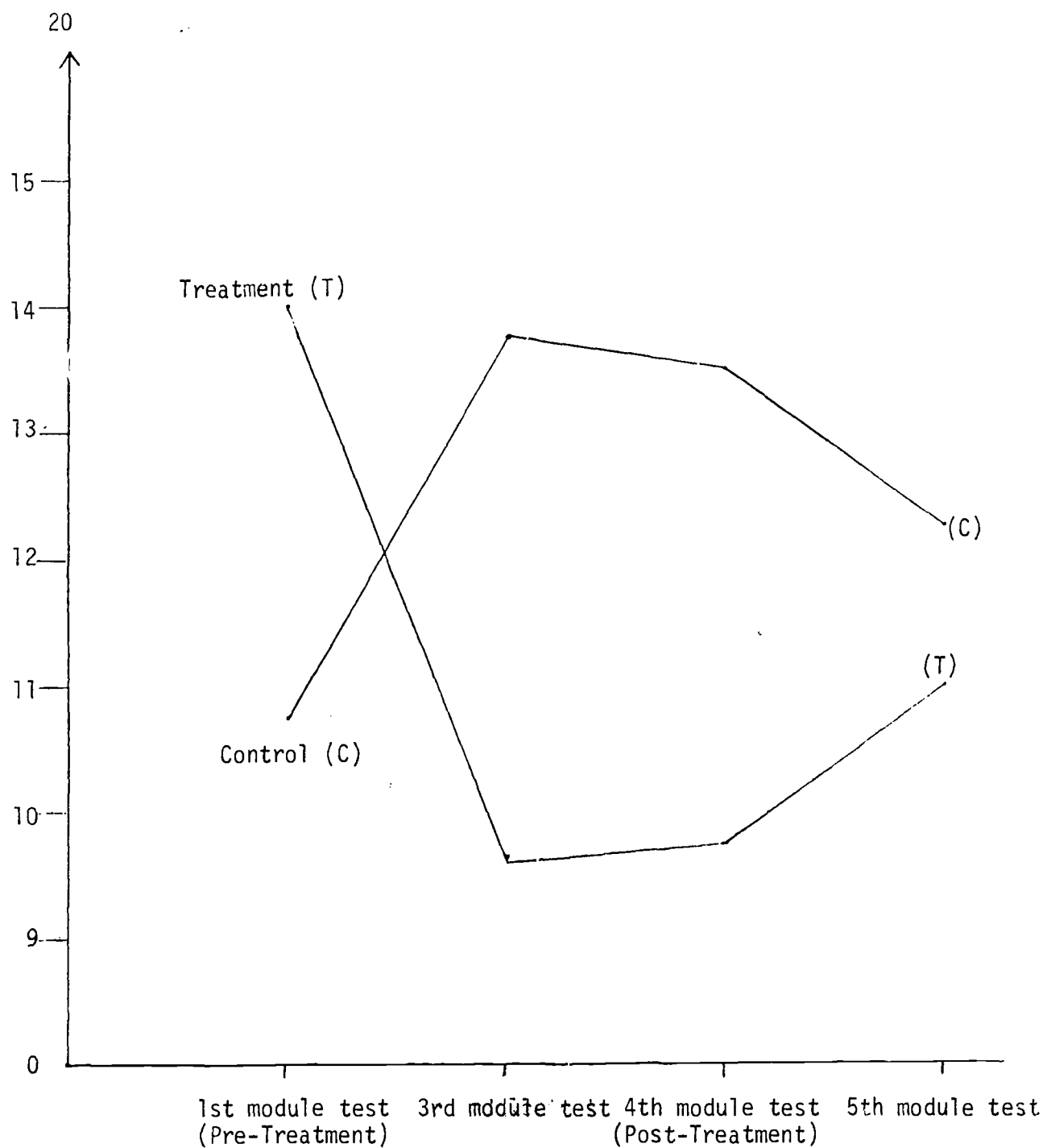


Figure 1. Levels of A-State for Treatment and Control Conditions Across Pre-Treatment and Post-Treatment Module Tests.



Table 3  
 MEANS AND STANDARD DEVIATIONS OF MODULE TEST SCORES  
 BEFORE AND AFTER TREATMENT FOR TREATMENT AND  
 CONTROL SUBJECTS

	Pre-Treatment Module Test 1		6	SD	Post-Treatment Module Test 7		8	SD
	$\bar{X}$	SD	$\bar{X}$		$\bar{X}$	SD	$\bar{X}$	
Treatment	.80	.18	.86	.08	.81	.07	.67	.10
Control	.77	.13	.77	.10	.80	.10	.71	.16

## DISCUSSION

The results show, in general, a striking reduction in general test anxiety and state anxiety during tests for the treatment as compared with the control subjects. The pretest to posttest reduction in STABS scores for the treatment group indicates a moderate reduction in self-reported general test anxiety immediately following treatment. Most importantly, the data analysis indicates a highly significant reduction in TAS scores for the treatment group as compared with the control group, with posttesting occurring about two weeks after the conclusion of treatment. This reduction in general test anxiety, as assessed by a self-report measure, compares very favorably with the results usually found in studies investigating the effects of behavior therapy for test anxiety. TAS scores for five of the eight treatment Ss were reduced by more than one-half, making the posttest treatment group TAS mean score approximately the same as the mean score for 330 students completing the TAS in the fall of 1972 and used as a norm group for selecting treatment and control group Ss. Generally speaking, the data analysis and Figure 1 indicate a significant decrease in A-State scores for the treatment group on all tests following treatment, and an apparent increase in levels of state anxiety for the control group subjects over the series of tests.

The results show no difference between the module test scores of the treatment group before and after treatment, and no difference between the module test scores of treatment as compared with control subjects after the former had completed the test anxiety program. It had been anticipated that a reduction in general test anxiety in these Ss might improve their performance on module tests, and in this respect the results are disappointing. However, there are a number of reasons why performance differences following treatment for test anxiety might not occur or be detected in these subjects on these learning tasks. These factors need to be carefully considered in interpreting the results of this study and planning for future research.

The published studies to date which have obtained a reduction in self-reported test anxiety have been about evenly divided between those that have and those that have not found an accompanying improvement in course grades or GPA (Allen, 1972). It has been observed (Allen, 1972; Hall, 1970) that

studies which show improved grades following treatment tend to be ones that have utilized clients requesting treatment for test anxiety from a counseling agency rather than subjects with high scores on test anxiety measures who are solicited to participate in research. Also, it appears (Allen, 1972) that improvement in academic performance is much more likely to occur if desensitization (or a similar anxiety reduction technique) is accompanied by instruction in study counseling techniques. Finally, a common clinical observation by behavior therapists is that some students requesting treatment for test anxiety indicate that high anxiety severely interferes with their performance on tests, while others, who may nevertheless experience extreme discomfort and disruption of many living patterns because of anxiety, report only slight impairment of their ability to perform near the upper limit of their knowledge or ability on tests. These latter students, of course, may avoid desired learning or educational experiences, or develop negative attitudes toward academic pursuits because of test anxiety. The subjects in this study were solicited to participate in research and received only a small amount of what might be called study counseling via the manual on coping with test anxiety, and no attempt was made to determine whether anxiety commonly interfered with their performance on tests.

Another set of factors relating to the nature of the learning and performance tasks in the computer-managed instruction context may also have decreased the likelihood of finding performance effects in the treatment group. First of all, students are given behavioral objectives to guide their study and are told that the module test questions are based on these objectives. They are also aware that they are taking criterion-referenced rather than norm-referenced tests. These features of the learning environment probably tend to reduce debilitating anxiety and its effects on performance for some students. Secondly, the majority of module test questions did not involve the type of complex cognitive activities that typically are most damaged by high anxiety--most, though not all, of the test questions were recall-type questions. These factors, along with the quite small number of subjects employed, make it something less than surprising that clear performance differences were not detected.

Finally, it should be noted that there were some slight indications of improved performance on the part of the treatment as compared with the control group in this pilot study. On the two module tests immediately following the program (modules 3 and 4) the mean test scores were higher for the treatment group, and Ss in the treatment group failed to reach criterion and took retests on only two occasions as compared with six for the control group. It is true that the groups performed at nearly an equal level in terms of test scores and retests on the fifth module taken later in the semester. However, students in general did much more poorly on this module as compared with the others, and it appears that the test questions were not so much difficult as obscure, making for a less adequate measure of achievement on that module. Only further research can determine whether these slight differences are indicative of treatment effects.

In the interviews following treatment, the Ss expressed, generally, very strong positive feelings about the program. Only one of the Ss appears, in retrospect, not to have been completely suitable for the program. This young man, who interestingly was the only S not to show a marked decline on the TAS at posttesting (in fact he showed a slight increase), said that he found the program interesting but not particularly helpful to him. He appeared to have strong (but not highly abnormal or pathological) feelings of tension and suspicion in relation to persons in authority who were more the source of his anxiety than difficulty with coping with anxiety and worries about his performance on tests. The interviewer agreed with him that his completing the program was not inappropriate, but that it was not aimed directly at his somewhat different concerns. The rest of the Ss appeared to have made correct judgments to the effect that their concern with tests was predominantly test anxiety rather than other problems.

The interview seemed to indicate that the manual on coping with test anxiety communicated a great deal of useful information to the students. All Ss found it interesting to read, and all but one commented spontaneously that the descriptions of test anxiety in the manual and its portrayal on the

modeling videotapes were very close to their experience. Several remarked how surprised they were to notice that they remembered most of the main points of the manual. Four Ss spontaneously related recent encounters with tests (all of them non-CMI tests in courses these individuals found particularly difficult or tense) in which they were able to successfully put to work some of the anxiety management techniques. In the opinion of the interviewer (an experienced behavior therapist), these Ss seemed very actively involved in trying to understand and apply the information and techniques conveyed to them, perhaps more so than clients receiving simple desensitization treatment for test anxiety. It was interesting to note that only four of these Ss indicated that they felt that anxiety regularly damaged their performance on tests. Suggestions for improvement of the program centered mainly on the final, practice test-taking session. It was clear that the intelligence test questions tended to arouse anxiety, and so were a good choice for this type of exercise. However, the Ss indicated they would have preferred some more information about the purpose of the session than was provided, and perhaps more structured practice or relaxation and appropriate self-talk techniques during the session. This suggestion will be incorporated into a current revision of the practice test-taking session.

Given the encouraging results of this pilot study so far as self-reported test anxiety is concerned, a larger-scale investigation is currently being carried out by the Computer-Assisted Instruction Laboratory to confirm these results with a larger sample of test-anxious students and to explore the effects of the test anxiety program on performance in the computer-managed instruction context in a more precise manner. A much larger number of subjects will be employed. The program will be presented as more of a service program than a research project, and Ss will not be paid for their participation. Some more refined measures of test anxiety which distinguish, for example, between the cognitive and emotionality components of test anxiety, will be employed. Also, Ss will be asked to estimate in advance of the program

the extent to which high anxiety actually interferes with their performance on tests in general and the type of test utilized in this computer-managed instruction course. Ss who indicate that their performance is impaired on this type of test will be looked at separately from the rest. It should be noted that eventually, when this type of program is available as a regular service, those students who decide to take the program will be the sort of self-selected clients who appear to benefit the most from it.

In terms of directions for future research, a probable next step will explore eliminating the relaxation and desensitization component of the program in favor of an increased emphasis on practicing test-taking and anxiety management skills at the terminal on test-like materials. This modification will eliminate certain activities, namely deep muscle relaxation and visualization of hierarchy scenes, which occasionally (although this did not occur in the sample chosen for this study) give clients difficulty and require the assistance of a professional. It will make the program maximally suitable for regular administration in a computer-based learning situation.

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